"EXPRESS MAIL" MAILING
LABEL NUMBER
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GAS BURNER FOR A COOKING APPLIANCE

FIELD OF THE INVENTION

[001] The present invention is generally related to gas cooking appliances, and, more particularly, to a gas burner having an improved gas port pattern for flame production.

BACKGROUND OF THE INVENTION

[002] Gas burners are known to generate carbon monoxide while being fired. Carbon monoxide is known to be harmful to humans if inhaled at a sufficiently high concentration. For example, if a gas cooktop is not adequately vented, the carbon monoxide concentration in a living space can build up to toxic levels. It has been determined that a concentration of carbon monoxide compensated for excess air, or air free carbon monoxide (AFCO), of greater than 800 parts per million (ppm) is unsafe for human inhabitants in the living space. Accordingly, safety organizations, such as the American Gas Association (AGA) require that cooktops cannot produce more that 800 ppm AFCO. It is known that one of the primary causes of carbon monoxide generation in gas burners is incomplete combustion. In the past, a number of techniques to assure complete combustion, such as increasing a burner grate height above the gas burner, reducing diameter of the burner orifices, or underrating the burner have been used to keep AFCO production below 800 ppm. However, these techniques may also reduce the heat transfer efficiency or heat output rate [British Thermal Units (BTU) / Hour] and consequently, increase cooking times, such as by increasing a time to boil rating for the burner.

BRIEF DESCRIPTION OF THE INVENTION

[003] A burner assembly is described herein as including a burner grate comprising a plurality of humps, integrally formed in a glass ceramic cooktop, and distributed around an opening in the cooktop. The burner assembly also includes a burner positioned in the opening. The burner includes a plurality of

burner ports, the pattern of the burner ports selected to restrict flame formation in a region proximate a burner grate, so that flames from the respective burner ports do not impinge upon the burner grate.

[004] A method for firing a burner assembly is described herein as including providing a burner assembly comprising a burner and a burner grate, the burner grate further including a plurality of humps, integrally formed in a glass ceramic cooktop, and distributed around an opening in the cooktop. The method further includes positioning the burner in the opening and configuring an array of burner ports in the burner to avoid flame formation in regions proximate the burner in correspondence with the humps, so that flames from the burner do not impinge upon any burner grate therein.

BRIEF DESCRIPTION OF THE DRAWINGS

[005] FIG. 1 is an exemplary perspective view of gas burner having an array of burner ports configured to avoid flame formation in a region above the burner beneath a burner grate.

[006] FIG. 2 is a cross section of the gas burner of FIG. 1 taken along section “A-A” through the array of burner ports and shows an exemplary port spacing configuration.

[007] FIG. 3 is a cross section of a gas burner taken through an array of burner ports and shows an exemplary port orientation configuration.

[008] FIG. 4 is a top view of an exemplary gas burner having an array of burner ports positioned in the top of the burner and configured to avoid flame formation in a region above the burner beneath a burner grate.

[009] FIG. 5 is a partial top view of an exemplary gas burner assembly comprising a grate of glass ceramic humps and a gas burner having an array of burner ports configured to restrict flame formation in a region proximate the burner grate.

DETAILED DESCRIPTION OF THE INVENTION

[010] FIG. 1 is an exemplary perspective view of gas burner 10 having an array of burner ports 12 configured to avoid flame formation in a region 16 above the burner 10 beneath a burner grate 14. While the burner of FIG. 10 is depicted as having a cylindrical shape with burner ports 12 positioned around the periphery of the burner 10, it should be appreciated by a skilled artisan that other shapes of burners, such as square, rectangular, and star shaped, and other port configurations, such as ports 12 positioned on top of the burner 10, may be used without departing from the scope of the invention. In addition, the support structure may include any type of support structure used to support a cooking vessel above the burner flame, such as a pot support, a wok support, grate fingers, or cooktop grates. The inventor has innovatively discovered that by positioning the burner ports 12, such as holes or slots in the burner 10, so that flames 22 provided from the ports 12 do not impinge on a structure supporting a cooking vessel above the burner, such as the burner grate 14, AFCO levels can be reduced compared to conventional burners. Advantageously, this novel technique can be used without significantly affecting the performance or efficiency of the cooking appliance or cooktop.

[011] As shown in FIG. 1, the burner ports 12 corresponding to regions 24 above the burner 10 unobstructed by the burner grate 14 may be symmetrically spaced apart by flame-free portions 18. For example, each flame free portion 18 may have a width of W4, such as between 0.09 inches and 0.1 inches for a 12,000 BTU/Hour. However, in regions 16 above the burner 10 beneath a burner grate 14, a burner grate aligned flame-free portion 20, having a width W1, for example, different from W4, such as between 0.2 inches and 0.3 inches for a 12,000 BTU/Hour burner, may be used so that no flames 22 are provided beneath the burner grate 14. As would be understood by a skilled artisan, the values of W1 and W4 are a function of the burner diameter and rating of the burner and may also be selected according the

location and size of the burner grate. Accordingly, flame formation in a region 16 above the burner 10 beneath a burner grate 14 may be avoided, while flames 22 may be provided in regions 24 not obstructed by the grate 14, advantageously resulting in reduced AFCO emissions compared to conventional burners.

[012] FIG. 2 is a cross section of the gas burner of FIG. 1 taken along section A-A through the array of burner ports 12 and shows an exemplary burner port spacing configuration. In FIG. 2, the burner grate 14 is depicted in phantom to indicate a relative location of the burner grate 14 with respect to the burner ports 12 in the burner 10. As shown, flame-free portions 18 between the burner ports 12 correspond to regions 24 above the burner 10 free from the burner grate 14. In an aspect of the invention, the burner ports 12 may be spaced in a symmetrical pattern, such as equidistant from each other, by the flame free portions 18. Advantageously, in regions 16 above the burner 10 and beneath the burner grate 14, burner grate aligned flame-free portions 20 may be provided so that no flames 22 are formed beneath the burner grate 14.

[013] In an aspect of the invention, a width W1 of the burner grate aligned flame-free portion 20 may be about the same as the width W2 of the burner grate 14 located directly above the flame-free portion 20. In another aspect, the width W1 of the burner grate aligned flame-free portion 20 may be greater than the width W2 of the burner grate 14. For example, the width W1 may be configured so that flames 22 (as shown in FIG. 1) provided from ports 12 on either side of the burner grate aligned flame-free portion 20 may burn close to the grate 14, but do not impinge on the burner grate 14 or burn directly beneath the grate 14. By configuring the ports 12 to coincide with regions 24 above the burner unobstructed by a burner grate 14, the AFCO of the burner can be reduced compared to conventional port arrangements, without substantially affecting the efficiency of the burner 10.

[014] FIG. 3 is a cross section of a gas burner taken through an array of burner ports 12, 26, 32, and shows an exemplary port orientation configuration. The burner grate 14 is depicted in phantom to indicate a relative location of the burner grate 14 with respect to the burner ports 12, 26, 32 in the burner 10. In an aspect of the invention, a port 26 coinciding with the burner grate 14 may be oriented to deflect a flame 22 provided from the port 26 away from the burner grate 14. As shown in FIG. 3, in regions 16 above the burner 10 beneath a burner grate 14, the burner port 26 may be inclined with respect to a radial direction 40 so that an outlet 28 of the port 26 is positioned in a region 24 above the burner 12 unobstructed by the burner grate 14. As a result, a flame from the port 26 is directed away from the burner grate 14. For example, the port 26 may be inclined from an inlet 30 to the outlet 28 by an angle, θ, of about 15 degrees away from the radial direction 40. However, as would be understood by a skilled artisan, the angle of inclination selected will depend on the geometry of the burner and the relation of the location and size of the burner grate 14. In another aspect, a port 32 may be bifurcated at an outlet end. For example, the port may have a "V"-shaped or "Y"-shaped configuration, where each arm of the "V" or "Y" is complementarily inclined away from a radial direction 40, so that the port has one inlet 34 and two outlets 36, 38 opening in the region 16 away from directly underneath the grate 14. A width W3 between the arms of the "V" or "Y" may be at least the width W2 of the corresponding burner grate 14. By orienting the ports 12, 26, 32 to direct flames provided by the ports into regions 24 above the burner unobstructed by a burner grate 14, AFCO emissions may be reduced compared to conventional burners.

[015] In another form of the invention, the burner ports may be configured on top of a burner. FIG. 4 is a top view of an exemplary gas burner 42 having an array of burner ports 44 positioned in a top 46 of the burner 42 and configured to avoid flame formation in a region above the burner beneath a burner grate 14. In FIG. 4, the burner grate 14 is depicted in phantom to indicate a relative location of the burner grate 14 with respect to the burner

ports 44 in the burner 42. As shown, flame-free portions 48 between the burner ports 44 correspond to regions 50 above the burner 42 free from the burner grate 14. Advantageously, in regions 52 above the burner 42 and beneath the burner grate 14, burner grate aligned flame-free portions 54 may be provided so that no flames 22 are formed beneath the burner grate 14.

[016] FIG. 5 is a partial top view of an exemplary gas burner assembly comprising a grate of glass ceramic humps and a gas burner having an array of burner ports configured to restrict flame formation in a region proximate the burner grate. Generally, the gas burner assembly 60 may include a burner grate 62 comprising a plurality of humps 64, integrally formed in a glass ceramic cooktop 66, and distributed around an opening (not shown) in the cooktop 66. A burner 68 may be positioned in the opening and may include a plurality of burner ports (such as can be seen in FIG. 1). The pattern of the burner ports may be selected to restrict flame formation in regions 72 proximate the burner grate humps 64, so that flames 70 from the respective burner ports do not impinge upon the humps 64 of the burner grate 62. In one aspect, the burner ports proximate the burner grate humps 64 may be smaller in cross section than burner ports positioned away from the burner grate humps 64, so that flames 70 from these ports are correspondingly smaller than flames 74 extending from burner ports positioned away from the burner grate humps 64. In another aspect, burner ports may be eliminated or blocked (such as can be seen in FIG. 2), in regions 72 proximate the burner grate humps 64, so that no flames are formed in regions 72 proximate the burner grate humps 64. Because grates 62 formed in glass cooktops 66 may transfer heat to the cooktop 66 and other elements of the cooking appliance, it is believed that limiting the amount of heat transfer can extend the life of the cooktop 66 and cooking appliance. Accordingly, the inventors have advantageously realized that by preventing flame impingement on the burner grate humps 64, potentially damaging heat transfer in the cooking appliance may be reduced compared to allowing flames to impinge upon the burner grate 62.

[017] In an aspect of the invention, burner ports aligned with positions proximate humps 64 of the burner grate may be partially blocked or completely blocked to reduce flame size or eliminate flames near the humps, respectively.

[018] Using the innovative burner configurations as exemplarily described above, the inventors have experimentally demonstrated that AFCO emissions are reduced compared to conventional burners. The inventors conducted experiments according to American National Standards Institute (ANSI) Standard Z21.1 for Household Gas Cooking Appliances. The experiments compared the AFCO performance of a comparably rated conventional burner and a burner having burner ports configured according to the exemplary embodiments depicted in FIGS. 1 and 2. In both cases, the burner grate 14 was mounted at the same height above the burner. Table 1 below depicts the exemplary results of a test at a pressure of 3.5 inches of water and an ambient temperature of 75 degrees Fahrenheit and shows reduced AFCO formation for the novel burner:

Conventional Burner				Novel Burner			
Time(Min)	CO (ppm)	O2 (%)	AFCO(ppm)	Time(Min)	CO(ppm)	O2 (%)	AFCO(ppm)
5	82	16.6	399	5	54	16.8	275
10	59	17.1	325	10	39	17.1	215

Table 1

[019] Table 2 below depicts exemplary results of a test of the burners (in the same test configuration as described above) at an increased pressure to provide a flow of 112% of burner rated value. This test was performed at an ambient temperature of 74.1 degrees Fahrenheit and shows reduced AFCO formation for the novel burner:

Conventional Burner				Novel Burner			
Time(Min)	CO (ppm)	O2 (%)	AFCO(ppm)	Time(Min)	CO(ppm)	O2 (%)	AFCO(ppm)
5	283	16	1207	5	82	16	350
10	115	16.1	501	10	73	16.1	318

Table 2

[020] In addition to the tests conducted above, a time-to-boil performance was conducted according to ANSI Standards Z21.1 and Z21.23 to verify that the efficiency of the novel burner remained substantially the same as the comparably rated conventional burner at the same burner grate height. Table 3 below depicts exemplary results of a test of the time-to-boil performance of a conventional burner and the novel burner. The Test setup included 5 thermocouples attached to copper discs of dimensions specified in ANSI Z 21.23. The test measured the time to raise the average temperature of 6 liters of water at one atmosphere of pressure and at 74.1 degrees Fahrenheit ambient temperature to a temperature of 190 degrees Fahrenheit from an initial temperature of 71.2 degrees Fahrenheit.

Conventional Burner	Novel Burner
25 min., 9 sec.	25 min., 20 sec.

Table 3

[021] As shown in Table 3, the time–to-boil performance is essentially the same for the novel burner compared to the conventional burner. Accordingly, as shown in Tables 1-3, the AFCO emissions can be reduced and efficiency of the burner can be maintained by configuring the array of burner ports in the burner to avoid flame formation in a region above the burner beneath a burner grate.

[022] While the preferred embodiments of the present invention have been shown and described herein, it will be obvious that such embodiments are provided by way of example only. Numerous variations, changes and substitutions will occur to those of skill in the art without departing from the

invention herein. Accordingly, it is intended that the invention be limited only by the spirit and scope of the appended claims.